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## TOOLS AND TECHNIQUES

### California Program for Sustainable Building Provides Better IEQ, Energy Savings, and Other Resource Efficiencies

by Leon Alevantis, M.S., P.E.

*[Editor's note: Leon Alevantis is deputy chief of the Indoor Air Quality Section for the California Department of Health Services and is a specialist in indoor air quality (IAQ) and ventilation. In his article, Alevantis describes the initial success and considerable promise of an ambitious state government program to construct state buildings that are sustainable, have enhanced indoor environmental quality (IEQ), and consume at least 30% less energy than California law allows. He also explains the implications of the program for the rest of the US.]*

Coordinated efforts by the state of California to address sustainability in state-government construction started in 1999 when the Legislature directed the California Department of General Services to incorporate sustainable-building measures into the design and construction of a \$392 million state office-building complex in Sacramento known as

the Capitol Area East End Complex (East End Complex).<sup>1</sup> This five-building complex encompassing 1.5 million square feet is scheduled for completion in 2003 and is the largest state government office-construction project in California history.

A multi-agency "Green Team" was formed under the direction of the Secretary of the State and

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Consumer Services Agency. In partnership with the California Integrated Waste Management Board, California Energy Commission, Department of Health Services, and California Air Resources Board, the Green Team worked with the Department of General Services to integrate sustainable building measures into this project. These measures included general requirements for improved IAQ, energy efficiency, environmentally preferred building materials, recycling, water conservation, and other resource efficiency measures.<sup>2</sup> Guided by the Department of General Services sustainability requirements, the two teams selected by the State to design and construct this complex developed their own sustainable designs and specifications. These include several specifications each that would promote healthy IAQ, energy efficiency, and efficient use of resources. The IAQ safeguards for building materials:

- Require manufacturers to test building materials according to a specified protocol (discussed later in this article).
- Specify formaldehyde-free ceiling tiles, paints, and thermal insulation.
- Specify the sequence of installing certain materials according to their volatile organic compound (VOC) emission characteristics.
- Require the builders to operate the HVAC system on maximum outdoor air during finish work.
- Specify a 30-day “flush out” [of building air] after substantial completion and before occupancy.
- Specify building air quality sampling prior to and after occupancy as part of the building commissioning process.

IAQ safeguards for heating, ventilating, and air-conditioning (HVAC) systems:

- Require airflow monitoring stations and minimum airflow injection fans so that the design minimum amount of outdoor air can always be supplied to each building.
- Specify 85% or higher efficiency air filters.
- Minimize the use of internal lining in the ductwork.
- Mandate that all oil residues be removed from the internal surfaces of the ductwork prior to installation.

- Require that the open ends of all ductwork be covered during transportation and storage.
- Stipulate that all open ends of the installed ductwork be covered.
- Require the HVAC systems and their components be easily accessible for inspection and maintenance.
- Specify local exhaust(s) for high-volume copier rooms.
- Mandate that all building outdoor air intakes be located upwind and at least 25 feet away from any potential sources of contamination, such as cooling towers and building exhausts.
- Specify proper slope for condensate pans to avoid accumulation of standing water.

To ensure energy and resource efficiency, the specifications state that the project must:

- Exceed the 1998 California energy code standards by at least 30%. (The 1998 version of this code on the average was fairly equivalent to ASHRAE Standard 90.1-1999. However, the 2001 version of the California code, on the average, is more stringent than the 1999 ASHRAE Standard. An average building that is 8% better than the 2001 California energy code is 20% better than the 1999 ASHRAE Standard).
- Have a building and IAQ commissioning plan.
- Maximize use of natural lighting.
- Specify materials that have a high percentage of recycled contents, a high potential for being recycled in the future, and are durable.
- Specify water-efficient irrigation and plumbing systems.
- Require LEED certification (The United States Green Building Council developed LEED, which stands for “Leadership in Energy and Environmental Design” and is a nationally recognized system for rating sustainable buildings).

### Energy Code IAQ Requirements

The California energy code standards, known as the Title 24 *Energy Efficiency Standards*,<sup>3</sup> include criteria for building envelope, HVAC, and lighting.

Title 24 specifies the following IAQ-related items:

- 15 cubic feet per minute (cfm) per person or 0.15 cfm per square foot (cfm/ft<sup>2</sup>), whichever is greater, for nonresidential buildings.

- HVAC system shall provide the minimum outdoor air and shall be measured by the installing licensed mechanical contractor.
- Carbon dioxide (CO<sub>2</sub>) controlled ventilation for areas with variable occupancy, such as meeting rooms and lecture halls (the effective ventilation rate cannot drop below 0.15 cfm/ft<sup>2</sup> and the CO<sub>2</sub> concentrations cannot exceed 800 ppm).
- The lesser of either three air changes per hour, or the minimum required ventilation rate one hour before people occupy the building each day.

One building, known as Block 225, is designed with a raised-floor air-distribution system and is the first state-government building in California to use such a system. Although this 479,000-ft<sup>2</sup> building is designed to supply 25 cfm of outdoor airflow rate per person (in excess of the Title 24 requirements), it will still exceed the 1998 Title 24 energy efficiency standards by 30%.<sup>4</sup>

The increased outdoor airflow and the inherently higher air mixing of the raised-floor distribution system will result in a more healthy, comfortable, and productive indoor environment. A study will be conducted to quantify these benefits. There are more than 100 sustainable building measures for Block 225. Excluding the raised-floor air-distribution system, these measures account for only 2.5% of the contract cost. Including the air-distribution system, they represent 8.2% of the contract cost.<sup>5,6</sup>

### Governor Issues Order

As a result of the success in using sustainable features at the East End Complex, Governor Gray Davis issued Executive Order<sup>7</sup> D-16-00 in August 2000, which requires the Secretary of State and Consumer Services Agency to develop a “roadmap” of how future state buildings can be designed, constructed, operated, and maintained in a sustainable manner. To implement this Executive Order, Secretary Aileen Adams convened a Sustainable Building Task Force<sup>8</sup> that involved more than 32 governmental agencies. This Task Force produced a report entitled *Building Better Buildings: A Blueprint for Sustainable State Facilities*.<sup>9</sup>

The report assesses the state government’s current sustainable building efforts and roadblocks in implementing sustainable designs in state construction, and lists 10 recommendations on how California can

achieve sustainable best practices. These practices include improving the air quality and comfort of indoor spaces while reducing energy beyond the most-current Title 24 code requirements. They also involve implementing whole-building commissioning practices, reducing water usage, and using environmentally preferred products for construction, as well as for ongoing maintenance.

One of the most difficult roadblocks to full-scale implementation of sustainable building practices has been allocating additional design and construction funds for such practices. This is because there is no single, widely acceptable method of measuring the costs versus the benefits of sustainable features over the life of a building. However, much of the recent data is indisputable; sustainable buildings are cost-effective in the long run, use natural resources more efficiently, and provide a healthier and more productive work environment.

Part of the knowledge gained at the East End Complex is now incorporated as *Exhibit C: Energy Efficiency and Sustainable Building Measures*<sup>10</sup> in the State Department of General Services Standard Agreement for all professional architectural and engineering services. Two separate checklists for specific energy efficiency and sustainable building measures are included in Exhibit C. The items on the first list, called Tier 1, are mandatory for all applicable projects. Tier 1 has been evaluated and deemed to be cost-effective by the California Department of Finance. The items on the second list, called Tier 2, can be incorporated as budgets permit on a project-by-project basis.

### State Specifies Preferred Products

California has also been developing specifications for environmentally preferred products. In 2000, with input from many state agencies, the office furniture industry, and private consultants, the Department of General Services issued benchmark environmental specifications for procuring office furniture systems (i.e., workstations). The *Environmental Specifications for Office Furniture Systems*,<sup>11,12</sup> which includes criteria for IAQ, recycled content, and lighting, was part of Department of General Services’ open bidding process and subsequent three-year, \$60-million contract for office workstations. As a result of this effort, state officials have formed a Sustainable Procurement Task Force. This multi-agency task force will use the

furniture specification process as a model for including environmental considerations in future procurement specifications. This effort includes major building materials such as carpeting, paints, ceiling tiles, and building insulation.

The specifications developed for office furniture systems were used by the design and construction teams at the East End Complex as the basis for developing their own *Special Environmental Specifications (Section 01350)* for a full range of building materials. These specifications include emissions-testing procedures and require certifications for recycled materials meeting the statutorily mandated State Agency Buy Recycled Campaign.<sup>13</sup> Section 01350 has now been rewritten for use on other projects and is included in two state publications: *Reference Specifications for Energy and Resource Efficiency*<sup>14</sup> and the *Collaborative for High Performance Schools: Best Practices Manual*.<sup>15</sup>

Because California's economic engine is so powerful — the fifth-largest economy in the world in 2000 — its ability to transform what the marketplace offers is tremendous. Consequently, building specifications developed by the California government could have national implications in how buildings will be constructed, maintained, and operated in the future. Similarly, given its multimillion-dollar purchasing power, commodity specifications developed for California will help drive a broad range of industries toward manufacturing more sustainable products.

Arnold Sowell, deputy secretary of California's State and Consumer Services Agency, recently said, "By ensuring that millions of square feet owned and operated by the state showcase sustainability, California state government continues to demonstrate its commitment to environmental leadership. Such a commitment promotes resource conservation, improves worker productivity, generates long-term savings, and helps to drive the market-transformation process."

Given California's recent energy crisis, great emphasis has been placed on energy-related issues. The sustainable-building approach balances energy issues with improved IAQ and resource efficiency. The California Executive Order on sustainability cited above has, at its core, the requirement to do more with less by using resources more efficiently while providing improved performance, comfort,

and healthier indoor environments. California's sustainable-building effort is gaining momentum across the state as local governments are embarking on their own sustainable-building programs.

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